13.	Program Counter (PC)	14.	Address bus
15.	16 to 32 bits	16.	2^{32}
17.	Address bus	18.	Data bus
19.	32 to 64 bits	20.	Control bus
21.	8 to 16 bits	22.	Data Transfer Instructions
23.	MOV	24.	LOAD
25.	STORE	26.	Data Processing Instructions
27.	Arithmetic Instructions	28.	Logical Instructions
29.	Shift Instructions	30.	Zero-Address Instruction
31.	One-Address Instruction	32.	Two-Address Instruction

Q.2 Give short answers of the following questions.

Q1: Define CPU.

Ans. The Central Processing Unit (CPU) is the main part of the computer, which performs all its activities. It is also called the processor or microprocessor and is truly the "brain" of the computer system. It combines the circuitry that generates all the control signals needed to execute instructions.

Q2: What are the main components of CPU?

Ans. The following are main components of CPU:

- ⇨ ALU
- ⇨ CU
- ⇨ Registers
- ⇨ Cache
- ⇨ Internal Buses

Q3: What is meant by ALU?

Ans. Arithmetic logic unit (ALU) is the part of the CPU where the actual processing takes place. ALU is capable of performing arithmetic, logical and data manipulation operations on data.

Q4: Which operations are performed by ALU?

Ans. The ALU consists of logic circuitry that performs operations such as addition, subtraction, multiplication, division, exponentials, data manipulations (for example, shifting), comparisons and logical operations such as AND, OR, NOT, etc. on the data contained in the registers.

Q5: What is CU?

Ans. Control unit directs and coordinates the activities of the entire computer system. It controls the working of all the input/output devices, all the primary and secondary storage devices and the calculations performed by the ALU. Control unit controls the operations of computer system based on the instructions in the program by executing them in a proper order.

Q6: What are the main components of CU?

Ans. Control Unit consists of three main components, Instruction Register, Instruction Decoder and Timing & Control Logic.

Q7: What is instruction register?

Ans. Instruction register stores the instruction while it is being executed.

Q8: What is instruction decoder?

Ans. Instruction decoder decodes (translates) it and timing and control logic generates the signals to execute it.

Q9: What are registers?

Ans. Registers are small memory devices whose function is to temporarily store data information and pass it on to the other parts of the processor or main memory during the processing. CPU contains several registers that are used to store various kinds of information needed by the

microprocessor as it performs its functions.

Q11: Write some commonly found registers inside the CPU.

Ans. Some commonly found registers inside the CPU are:

- ⇨ Instruction Register
- ⇨ Accumulator Register
- ⇨ Data Register
- ⇨ Program Counter
- ⇨ Memory Address Register

Q12: What is cache memory?

Ans. Cache memory is a very small amount of memory inside the microprocessor. It is faster than main memory but it is very expensive. It stores some active portion main memory, which is frequently required by the CPU

Q13: Define bus.

Ans. A bus is a group of parallel wires used for transmitting data/information from one part of the computer to another. In other words, it provides a pathway for transmitting data/information among various components off computer.

Q14: Define internal buses.

Ans. The buses that are found inside the CPU are known as internal buses.

Q15: Name the types of buses inside microprocessor.

Ans. There are three types of buses inside microprocessor, which are:

- ⇨ Address Bus
- ⇨ Data Bus
- ⇨ Control Bus

Q16: What are general-purpose registers?

Ans. General-purpose registers are used to store data as well as addresses. These registers are used for anthmetic data movement. Typically, these are 8 to 32 bit registers.

Q17: What are Accumulator Register (AC) and Data Register (DR)?

Ans. These two registers hold the operands (values) that the ALU operates on during the execution of an instruction. Operands are values on which operations such as addition or multiplication is to be performed Operands are loaded into these registers from memory. After performing the operation, the results of ALU are transferred to the accumulator (AC). Both the accumulator and the data registers can receive data from memory over the data bus but only the accumulator can send data/information back to the memory.

Q18: What is base register?

Ans. Base Register is used to hold a number that can be added to (or, in some cases, subtracted from the address portion of a computer instruction to form an effective address. It is also known as Index register.

Q19: What does counter register contain?

Ans. Counter Register contains the address (location) of the instruction being executed at the current time. As each instruction gets fetched, the Counter register increases its stored value by 1. After each instruction is fetched, it points to the next instruction in the sequence. When the computer restarts or is reset, it normally reverts to 0.

Q20: What is Instruction Register (IR)?

Ans. Instruction register holds program instructions that are fetched from the memory for execution. It holds the instruction while the instruction decoder circuit decodes it. After decoding, the timing and control logic generates the proper sequence of control signals to complete the execution of the instruction.

Q21: What is memory address registers?

Ans. Memory address register hold the address of memory location from where a memory word is to be fetched or where data is to be stored.

Q22: What is Memory Buffer Register (MBR)?

Ans. A memory word that is to be stored in or to be fetched from memory must first transferred into MBR. MBR acts as a buffer (a small temporary memory) allowing to microprocessor and memory unit to act independently without being affected by minor differences in operation.

Q23: What is the function of Program Counter (PC)?

Ans. Program Counter controls the sequence in which instructions are fetched from memory. At any given instant, the contents of PC indicate the address in memory from which the next instruction is be fetched. Contents of PC are loaded into MAR to fetch an instruction from memory. After fetching an instruction from memory, the PC is incremented by one to point to the next instruction to be fetched.

Q24: What is the fundamental operation of most CPUs?

Ans. The fundamental operation of most CPUs is to execute a sequence of stored instructions called a program. The program is represented by a series of instructions that are kept in some kind of computer memory.

Q25: Which steps CPUs use in their operations?

Ans. There are four steps that CPUs use in their operations, these are:

- ⇨ Fetch
- ⇨ Decode
- ⇨ Execute
- ⇨ Store

Q26: How many fields an instruction has?

Ans. An instruction has two fields:

1. Operation code, which represents the action that the processor executes.
2. Operand code, which defines the parameters of the action. The operand code depends on the operation. It can be data or a memory address.

Q27: How many types of instructions are used in computers?

Ans. Modern computers support many types of instructions. The following are some general types of instructions used in computers:

- ⇨ Data Transfer Instructions
- ⇨ Data Processing Instructions
- ⇨ Program Control Instructions

Q28: Into how many types, data manipulation instruction can be divided?

Ans. Data manipulation instructions can be divided into three basic types:

- ⇨ Anthmetic Instructions
- ⇨ Logical Instructions
- ⇨ Shift Instructions

Q29: Define JMP instruction.

Ans. The JMP instruction jumps to begin the execution at another location.

Q30: Define LOOP instruction.

Ans. The LOOP instruction is used when number of statements is to be repeated.

Q31: How many parts of instruction format are there?

Ans. Instruction Format consists of two parts:

- ⇨ Op-Code
- ⇨ Operand

Q32: Define Op-Code.

Ans. Op-Code is a group of bits that define various processor operations such as LOAD, STORE, ADD and SHIFT to be performed on some data stored in registers or memory.

Q33: What are the common instruction formats?
Ans. Some common instruction formats are discussed as follows:

- ⇨ Zero-Address Instruction
- ⇨ One-Address Instruction
- ⇨ Two-Address Instruction

Q34: What is the purpose of two address instruction?
Ans. Two Address instruction format requires one op-code and two operands.

Q35: Define instruction cycle.
Ans. Instruction cycle is the basic operation cycle of a computer to execute various instructions. A computer retrieves an instruction from its memory, determines what actions the instruction requires, and carries out those actions by the process.

Q36: What are the steps involved in instruction cycle?
Ans. The following are the three instruction cycle steps:

- ⇨ Fetch operations
- ⇨ Decode operation
- ⇨ Execute operation

Q37: Give some examples of CISC architectures.
Ans. Examples of CISC processors are the Intel 486 series and Pentium series.

Q38: Give some examples of RISC processor.
Ans. Examples of RISC processor are

- ⇨ IBM PowerPC
- ⇨ Sun SPARC
- ⇨ Mobile phones
- ⇨ Tablet PCs

Q39: Write down any three between CISC and RISC architectures.
Ans. The following are few differences between CISC and RISC architectures.

1. CISC instructions utilize more cycles than RISC.
2. CISC has way more complex instructions than RISC.
3. CISC typically has fewer instructions than RISC.

Q40: State the features of Intel Pentium IV.
Ans. Intel Pentium IV processors have 20 steps execution process. They have high clock speed and perform fewer operations per clock. Pentium processors generally use 478 pin sockets and use Mega Hertz (MHz) to specify processor speed.

Q41: State the features of AMD Processor.
Ans. AMD processors have 10 steps execution process. These processors generally use 462 pin sockets. AMD processors do not use Mega Hertz (MHz) to specify processor speed. This is due to the instruction set handling that AMD uses.